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ABSTRACT

This paper discribes the analysis of data in the Management Implications of Team Teaching Project (MITT). It touches on the interviews conducted with teachers and principals, presents the breadth of information obtained in the questionnaire, and explains how the data were aggregated and how issues were grouped. Information collected in the interview focused on how decisions were made in schools in a number of areas. The task was to develop indices by which decision-making in each school could be characterized. The researchers formulated nine types of control structures on the basis of the interface between the "input population" (who made the decision) and the "output population" (who were affected by the decision). The evidence gathered was combined into groupings to reflect components of the instructional program about which decisions were made. Profiles were clustered through multidimensional scaling, internal analysis was conducted resulting in recombination of the clusters, and a complex external analysis was conducted. (JM)

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CREATING INDICES FROM THE CONTROL STRUCTURE INTERVIEW THROUGH DATA COLLAPSING AND MULTIDIMENSIONAL SCALING: APPROACHES TO DATA ANALYSIS IN PROJECT MITT

By

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Introduction

The development of the Control Structure Interview focused around three concerns: arenas for decision-making, who makes the decisions and who is governed by them. We wanted to be able to obtain relatively detailed evidence concerning issues about which decisions would be made recurrently and deliberately. Each such issue, indeed each piece of evidence about the issue, was conceptualized as having a particular type of authority structure or, as we have preferred to call it, control structure. That is, the concept of control structure centered around the notion that one could identify for any issue about which a decision has been made, who made the decision or had input to it (the INPUT population) and who was/is governed by it (the OUTPUT population). This is a structural orientation which deals with the boundaries of control in decision-making, and sidesteps more dynamic aspects surrounding decision processes themselves or the nature of compliance.

We wanted the instrument to allow flexibility in the specification of evidence about decision issues in each school and in the designation of the nature of the INPUT and OUTPUT populations. This required a substantial level of detail for both the decision issues and the populations. The set of issues would have to be sufficiently discrete to permit us to assess whether relationships existed between types of decisions and types of control strucutre. It was also crucial that we be able to identify a variety of types of control structures that might arise and evolve, in particular by virtue of unitization. For example, in those schools which adopted units, we expected new INPUT and OUTPUT populations to appear in the form of unit leaders individually and collectively. We also wanted to be able to assess

simultaneous change in the relative prominence of the different control structure types with respect to decisions. If one type gained prominence, e.g. collegial decision-making, which one or several would show atrophy with respect to a particular issue? This required an inventory of individuals and groups in and out of the school who potentially would be involved in decision-making and/or be governed in some fashion by that decision. Our instrument, therefore, had to be amenable to detecting different types of control structures for the myriad of detailed evidence about each decision issue.

We identified seven general arenas for which we could identify issues about which decisions would be made in the schools. These were:

1. Curriculum scope and balance
2. Instructional materials
3. Methods of instruction
4. Methods of reporting student evaluations
5. Methods of responding to student misbehavior
6. Grouping of students
7. Hiring practices

Issues were framed under each; because we wanted relatively detailed evidence concerning these issues, for each we identified an inventory of topics each of which itself was a potential sub-issue about which a decision could have been made at some point. For example, under curriculum scope and balance, one issue was "the decision to teach the subjects taught in the last four weeks." However, the real details of this issue could be obtained by

addressing the issue to each specific subject the teacher taught; that is, if s/he taught math, a decision had apparently been made that s/he would teach that specific subject.

For this same arena there were three other decision issues which could be addressed to each individual subject in a like manner. These issues concerned decisions about what the teacher was asked specifically not to teach, decisions to present particular lessons for the subjects taught, and decisions concerning the scheduling in the curriculum of each subject taught. Therefore, under curriculum scope and balance we had a list of 25 subjects, each constituting a potential topic for or piece of evidence about each of the four decision issues.

The same kind of thing was done for each of the other arenas. A set of issues concerning decision making was identified; wherever applicable, a list of topics/pieces of evidence was made to which each or most of the issues could be individually addressed. It became apparent that our best means of obtaining this data was through intensive, detailed interviews with knowledgeable informants in each school who would describe the specifics of decision making in a variety of areas. The only viable alternative for getting such detailed information, that of stationing observers in the schools to make first-hand documentations of the decision processes, was beyond the mans of the project.

The project staff launched a six-month effort to develop an appropriate interview schedule and recording form. Several trial forms were produced, field tested with local informants, and the responses reduced to the requisite indicators of control structure as a test of their ultimate utility. Proce-

dures for training interviewers were also worked out. The final form of the so-called control structure interview and the rules for data reduction and index construction are presented in this report.

The interview procedure was broken down into two steps. The first was concerned with identifying the individual pieces of evidence addressed by each issue. Suffice it to say here that the interviewee was sent a self-administered questionnaire which was designed to tap this information. A more detailed description of the format of this questionnaire can be found in Packard, et al (1976).

The instrument was administered to principals and to a sample of "informed" teachers in each school. The interview with the principal, whose position provides proximity to decisions from which teachers are typically removed, differed from that with teachers only insofar as slight modifications of wording were required to direct him/her to consider decision making from the teachers' rather than the administrators' perspective. In addition, principals were probed about the area of hiring practices. Informants were defined as teachers who are likely to know who makes what decisions by virtue of their experience, position, tenure, and prestige in the school.

For the first wave of data collection a sample of informants was drawn randomly so that no more than nine teachers and the principal were interviewed in each school. This approach was followed due to the lack of information

which would identify "best" informants. On subsequent data collections following acquisition of a great deal of information about each of the members of every faculty, a smaller number of teachers was selected largely from the original sample who best fit the informant criteria.

Information Collected in the Interview

The breadth of potential information obtained in the self-administered questionnaire follows with a separate description of the issues and pieces of evidence comprising each decision arena. Note that the decision issues are framed as questions, which is the form in which they were presented to the respondents.

Each question listed under Decision Issues defines the nature of the issue about which a decision had been made regarding each relevant piece of evidence that the respondent mentions. Each piece of evidence indicated represents a separate decision under the respective issue.

Curriculum Scope and Curriculum Balance

Decision Issues

1. What subjects have you taught in the last four weeks?

2. At this time are there any subjects which you are explicitly asked not to teach to the children you teach?

   Responses for each Subject in List:

   1. Yes, asked not to teach.
   2. No, not asked not to teach.
   3. Don't know.

   Respondent could also indicate if there were no subjects at all that s/he were instructed not to teach--this allowed the interviewer to shortcut the interview by not going through each subject individually.

3. The lessons which you present for each subject you teach.

4. The scheduling of each subject you teach.

Evidence: Subject Areas

01--Spelling
02--Reading
03--Other language arts
04--Foreign language
05--Mathematics
06--Social studies
07--Science
08--U.S. history
09--World history
10--Geography
11--Health
12--Art
13--Music
14--Physical education
16--Other
17--Religion
18--Crafts(weaving, ceramics)
19--Drama
20--Values
21--Handwriting. penmanship
22--Drug education
23--Phonics
24--Career education
25--Manual arts (woodworking)
26--Home ec. (sewing, cooking, nutrition)
27--Citizenship

Instructional Materials

Decision Issues

1. What materials are usually in the school?

2. What materials have you used in the last four weeks?

3. What materials have you been asked not to use?

Evidence: Materials

01--Textbooks
02--Workbooks
03--Other books
04--Programmed materials
05--Audio-visual equipment
06--Audio-visual materials (films, etc.)
07--Construction supplies (used up during use)
08--Construction tools
09--Games and puzzles
10--Language labs
11--Laboratory equipment
12--Sports equipment
13--Other
14--Office equipment
15--Office supplies
16--Diagnostic tests
17--Reading labs.
18--Math labs.
19--Magazines and newspapers
20--Instructional kits
21--Homemade supplies made by teacher and/or student

Methods of Instruction

Decision Issues

1. What methods of instruction are used in the school?

2. For which methods of instruction is use restricted?

Evidence: Methods

01--Lecture to class
02--Recitation by pupils
03--Grou discussion
04--Question & answer period
05--Field trip
06--Audio-visual presentation
07--Programmed learning
08--Use of outside persons, speakers
09--Laboratory work
10--Individual instruction
11--Performance contracting
12--Games or contests
13--Independent study
14--Projects: individual or group
15--Other
16--Peer helping peer
17--Tutors
18--Dramatics (role playing)
19--Small group instruction
20--Teacher aides
21--Learning centers
22--Team teaching

Methods of Reporting Student Evaluations

Decision Issues

1. What methods of reporting are used in the school?

2. How frequently is each method mentioned used?

Evidence: Methods of Reporting

01--Regular report card sent to parents
02--Special note sent to parents
03--Regular personal conference with parents
04--Special personal conference with parents
05--Telephone conference with parents
06--Other method of reporting
07--Work or examples sent home
08--Special or supplementary progress-reports

09--Written narrative
10--Pupil progress check lists
11--Test results reported
12--Informal (unscheduled) contacts with parents
13--Parents observe classroom

Methods of Responding to Student Misbehavior

Decision Issues

1. Which ways were used in the last week to respond to student misbehavior?

2. Which ways were you asked not to use?

Evidence: Methods of Responding

01--Withdrawing privileges from pupil
02--Scolding pupil, either privately or in front of class
03--Sending note to parent(s), include telephone parents
04--Individually counseling pupil
05--Arranging a conference with parents.
06--Sending pupil from class: sending to counselor, principal, hallway, etc.
07--Detaining pupil: after school
08--Detaining pupil: during recess, lunch
09--Requiring extra work
10--Spanking pupil (on hand, cheek, bottom, etc.)
11--Using other physical punishment: push-ups, etc.
12--Giving unsatisfactory conduct grades
13--Punishing group as a whole
14--Separating pupil from class: e.g., having pupil sit or stand in corner.
15--Threatening to use any of the above
16--Other response
17--Rewarding positive behavior
18--Embarrassing, humiliating
19--Ignoring
20--Behavior modification specifically mentioned extreme
21--Other physical punishment--extreme restraints or abuse
22--Unsupervised isolation of student
23--Not giving special privileges

Grouping of Students

Some evidence was gathered from teacher informants, other from principals.

Teacher Evidence

1. During the last four weeks, how many different groups of children have you taught?

2. For each group of children, do the children in that group have any special characteristics which distinguish them from other children in the same grade, such as ability, sex, interest, etc.?

   Response: For each group mentioned, the teacher answers either "yes" or "no." Each group, then, represents a piece of evidence about which a "yes" or "no" decision was made with respect to grouping by special characteristics.

3. How many children were in each group?

4. What grade(s) were included in each group?

5. In which groups, if any, did subgrouping occur?

Principal Evidence

1. In this school are all classes based on age only, or are some based on other characteristics as well?

   Response: Principal either (1) age only or (2) other characteristics as well. If #2 is indicated, then the following question is also asked.

2. How many classes are based on other characteristics as well?

Hiring Practices

Principals were asked separate questions about hiring practices used for permanent teachers, teacher aides, and teacher substitutes.

Decision Issues

1. How many (a) permanent teachers, (b) teacher aides are in your school?

2. What are the requirements to be hired as a (a) permanent teacher or (b) teacher substitute? A maximum of four requirements was requested.

Evidence

00--None (no 2nd/3rd/4th requirement)
01--Certification (professional certification, state certification)
02--State Board of Education requirements
03--County requirements
04--Board of Education approval (city-wide substitute list)
05--Two years college (64 semester hours)
06--College degree
07--Classroom experience
08--Adequate training
09--Satisfactory college record
10--Recommendations
11--Personal interview
12--Health examination
13--Certification in specialized field
14--Other

Decision Issue

3. What are the requirements to be hired as a teacher aide? A maximum of four requirements was requested.

Evidence

00--No teachers aides (no 2nd/3rd/4th requirement)
01--No requirements
02--High school graduate

03--Some college
04--College degree or equivalency
05--Aide training course
06--County requirements
07--Federal Title I guidelines
08--State requirements
09--Local residency
10--Experience working with children
11--Other experience
12--Typing skill
13--Health examination
14--Other

Decision Issue

4. What other characteristics are sought in hiring (a) permanent teachers and (b) teacher aides? A maximum of four characteristics requested.

Evidence

00--None (no 2nd/3rd/4th characteristic)
01--Academic record (college grades, good scholastic record)
02--Teaching experience
03--Advanced degree (M.A. preferred)
04--Racial (must abide by racial quota)
05--Good recommendations
06--Interest in children (desire to work with children, concern for children, child centered)
07--Professional dedication (belief in value of education)
08--Intellectual interests (scholarship, knowledge)
09--Creativity
10--Flexibility (adaptable to change, willingness to try new ideas)
11--Open-mindedness (freedom from bias)
12--Ability to work with children
13--Ability to control (firm but kind disciplinarian)
14--Ability to work with others (congeniality, cooperative)
15--Personality, non-specific
16--Well-adjusted, mentally stable
17--Humane, humanistic
18--Character (good moral character, Christian principles)
19--Health
20--Appearance
21--Other

SPECIFICATIONS OF INPUT POPULATION AND OUTPUT POPULATION

The interviewee was probed about three population aspects related to decision-making in each piece.

1. Where were the decisions made pertaining to each particular bit of evidence?

   We furnished a list of response categories; #7-#9 were used when the respondent could not pinpoint specifically where the decision was made.
   0--No answer
   1--Outside your local school
   2--Within administration of your own school
   3--Within your teaching staff
   4--With yourself
   5--Don't know
   6--With non-teaching staff
   7--2 and 3
   8--1 and 2
   9--1, 2 and 3

2. Who made the decision about the bit of evidence?

   For example, who decided that the teachers would use the lecture method in the classroom, who decided that phonics would not be taught?

   Responses to this question identified the input population for a decision about the bit of evidence under consideration.

3. Who was governed by the decision?

   Responses to this identified the output population for a decision about the bit of evidence under consideration.

Note: Question #1 was originally used as a means of crosschecking responses to questions #2, e.g., if the respondent said the decision was made outside the school and then responded to question #2 with "members of the staff," the interviewer would be alert to an inconsistency and probe the incompatible responses.

The Response Categories were the same for the Input and Output populations:

1--Education personnel outside your school; i.e., Federal officials, state legislators, state education officials, district school superintendent; district school board, other teachers in district or state but outside local school.
2--Your school principal
3--All teachers in your school
4--Some teachers in your school
5--Self (individual teacher on Principal's form as coded as 16)
6--Other
7--Don't know
No answer (questionnaire blank)

If the response to either input or output population questions was "some teachers in your school," the interviewer probed further to identify the nature of team involvement in the decision.

Team Involvement/Noninvolvement Response Categories:

Team Involvement
1--Entire team
2--Team leader
3--Other part of team
4--IIC (Instructional Improvement Committee--made up of all team leaders)

No Team Involvement
5--Teachers of a given grade--i.e., "all 4th grade teachers"
6--Teachers of a given subject--i.e., "all science teachers"
9--Code 4 circled on form but none of the above codes apply
0--Population for this decision does not include "some teachers," code 4 not circled on form.

Note: Codes 1-4 have priority over codes 5 and 6; e.g. "entire 4th grade team" coded "1", not "5".

If the response to either input/output populations questions was "other" or if the response to either was "some teachers in your school" but none of the team involvement alternatives applied, then the interviewer probed about additional possibilities.

Additional Specification of "some teachers" and "other"--Response Alternatives

1--Inside school committee
2--Outside school committee
3--Undesignated committee (unable to determine whehter inside or outside school)

4--Specialist(s)*
5--Inside school committee plus specialist(s)
6--Outside school committee plus specialist(s)
7--Undesignated committee plus specialist(s)
0--Above codes do not apply for this population but do apply for one or more populations involved in one or more decisions for this committee
Blank--No additional specification of "some teachers" or "other"

*Includes Librarian, Psychologist, Counselor, School Nurse, and also special teachers such as Art, Music and Phys. Ed. teachers when they serve in advisory capacity to classroom teachers.

Present Perceptions and Preferences About Governance

These questions were designed to tap some general impressions about who makes decisions in general task areas and who the respondent would prefer to see making those decisions. These were essentially designed as a gross check against some of the more detailed information collected in Step 2 of the interview and a potentital tie to other variables in the MITT study. The final 2 questions were an attempt to tap potential reactivity of our interview.

In the following presentation, A and B are stems to questions to be completed with each of the number phrases.

A. Who makes the decisions most often about. . .

B. Who would you prefer to make the decisions most often about. . .

1. What subjects you teach or what subjects are taught in the school?

2. How often you teach each subject or how often each subject is taught in the school?

3. What teaching materials you use or what teaching materials are used in the school?

4. What teaching methods you use or what teaching methods are used in the school?

5. How you report your evaluation of students or how teachers' evaluations are reported in the school?

6. how you respond to misbehavior or how teachers respond to misbehavior in the school?

7. What grades and kinds of students you teacher or what grades and kinds of students each teachers teaches in the school?

8. The hiring of teachers?

Response Categories
1--Others
2--Self
3--Both
4--No answer

C1-C4. To what extent do decisions made by. . .

1. The District School Board. . .
2. Other education officials outside the local school. . .
3. Teachers in this school . . .
4. Yourself. . .

. . . .affect your teaching or teaching in this school?

Response Categories
1. Too much
2. Just right
3. Not enough
4. No answer

D. In general, how do you feel about who makes decisions which affect your teaching or teaching in your school?

Response Categories
0. No answer
1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied or dissatisfied
4. Somewhat dissatisfied
5. Very dissatisfied

E. What changes would make you more satisfied with who makes these decisions?

1. The individual teacher should have more part, power, say, influence in decision making. Either in general or in specific areas.
2. Teachers as a group should have more part, power, say, influence in decision making. Either in general or in specific areas. Either all teachers, or the team, or other sub-group of teachers.

3. The teacher or teachers and the principal or administration should share more decision making power, should work together more, should communicate more.
4. The school board, state boards or other outside education body, and the individual school administration and/or teachers should share more decision making power.
5. Outside personnel should be more informed about needs, activities at the individual classroom or school.
6. Teacher or teachers could use more help, supervision from the administration or from outside.
7. No changes would improve satisfaction.
8. Other
9. No answer
0. Inapplicable--responds to question D with a "very satisfied" or "no answer"

F. As a result of this interview, have your ideas changed about how those decisions which affect your teaching are made, or have they remained the same?

1. Changed
2. Same
9. No answer

G. In what way have they changed?

Verbatim response was recorded.

This all, then, constituted the source of raw data for a single respondent. Our task was to develop indices by which we could characterize decision-making in each school with respect to the decisions covered in the interview. Our efforts led to creation of Control Structure Indices for each school.

Operationalization of Control Structure

Before going on, we must distinguish between the control structure of a decision and that of a school. We formulated the types of control structures on the basis of the interface between Input and Output populations

whenever a decision was made. In this respect, the Input population is (are) the decision maker(s); the Output population consists of those whose behaviors are implicated by the decision made by the Input population. By combining the responses indicating who constitutes each of these populations for each piece of evidence we could define the type of control structure. Our concept of structure here is cast in terms of types of control, and for any particular decision, these types are defined by who makes the decision and who is affected by it. For any school, all decisions of a kind, such as all classroom-related decisions, will be distributed among these particular types of control structures. Those falling under a certain type implicate the existence of that same type of control structure in the school. For example, those decisions made by a group of teachers and affecting that same entire group of teachers have a Collegial Control structure in the school; if 40% of all classroom-related decisions are made this way then the Collegial Control Structure Index for that school is 40%. Over all decisions we can calculate the proportion that implicate each other type of control structure. The complexities of arriving at these proportions, which constitute our school-level indices of control structures, follow below.

Our depiction of decision-making in a school this way is unique. It allows us the capability of describing schools which differ by governance structure in subtle ways. Definition via Input and Output populations directly taps the status of centralization-decentralization in a school. And, the indices are amenable to identifying change over time in school governance practices on several independent vectors. For example, many

schools adopting unit formation were expected to increase in group decision-making and decrease in teacher discretion.

The types of control structures were initially identified in an earlier monograph (Packard, et al, 1976) as five decision types: Collegial, Leader Determined, Shared, Removed, Teacher Discretion. We abandoned that initial distinction, in part, reformulated some of the types, and disaggregated some of the data, so that we had a total of nine types. These are presented in Table 1.

In the symbolic representation accompanying the breakdown of Control Structure below, each upper case letter represents a member of the Output population--for our purposes, Output members are always and almost exclusively teachers; each lower-case letter represents a non-member of the Output population--p represents principal, o represents some other nonteacher, t is a teacher.

Table 1: Types of Control Structure

Disaggregated	Input	Output	Aggregated
Collegial	ABCD	ABCD	Collegial (Type C)
LEADER DETERMINED SHARED--	A	ABCD	
principal bounded discretion	pA	A	
SHARED--teachers only	tAB	AB	
SHARED--principal & teachers	pAB	AB	Shared (Type S)
SHARED--teachers & nonteachers	oAB	AB	
REMOVED--principal input	p	ABCD	Principal (Type P)
	pE	ABCD	
REMOVED--non-teacher input	o	ABCD	Outside (Type O)
	ot	ABCD	
DISCRETION	A	A	Discretion (Type D)

A collegially-made decision is one for which all members of the output population are members of the input population. In a leader-determined decision, one teacher constitutes the input population; s/he and other teachers constitute the output population. The leader-determined decision departs importantly from the collegial variety. Here some but not all output population members comprise the input population. The only other restriction placed on the leader determined decision is that the output population must have at least two members. Otherwise the absolute size of either population is irrelevant. The input side must have at least one fewer member than the output side. (With large populations, four or more members, the distinction between leader determined and collegial decisions may seem rather arbitrary. This case did not occur frequently enough to warrant concern.)

For shared-decisions teachers are involved in making the decision. The shared decision is distinct from the two prior types in that a non-member of the output population, perhaps the school principal or counselor, is also depicted as a member of the input population. (The codes aA:A and aABCDEF:ABCDEF are also classified as shared decisions. In the latter example, once again the distinction between the collegial and shared decision might seem rather arbitrary. We think not. Even at such a fine level of discrimination the differences in input populations between the two types constitute an important difference in governance).

There are four types of shared decisions: (1) "bounded discretion" in which the principal and a single teacher made a decision which affects

that teacher, (2)"teachers only" in which one teacher helps make a decision for and with other teachers but s/he is not affected by it, (3) "teachers and principal" which is the same as bounded discretion except more than one teacher is involved in making the decision and is affected by it, and (4) "teachers and nonteachers" which is the same as teachers and principal except principal is replaced by a nonteacher such as the librarian or a central office person.

With removed decisions no person in the Output population is in the Input population. There are two types: (1) "principal" in which the principal is a member of the input population but not necessarily the sole member, and (2) "others" which is the same as above but the principal is replaced by someone who is a nonteacher.

A discretionary decision occurs if a single teacher constitutes the input and output population. Literally, a decision made at the teacher's discretion has no control structure since it implies someone, in addition to or exclusive of the teacher, is a member of the input population.

The data from all respondents were first output in a matrix; across the top were listed nine types of control structures, down the side were the evidence pieces for each task area. Entries were frequency of respondents, across experimental and control schools, reporting the type of the control structure applying to the decision about each particular piece of evidence. Total frequencies of responses appeared in the margin, and an accompanying table presented the percentage of respondents reporting that a decision about a piece of evidence had a particular control structure.

We had decided to use wave 3 data. Data at T1 was collected on a slightly different sample than at the other waves. We also assumed that T3 responses would be more stable and realistic than those at T2, at which time a lot of instability was taking place in the schools.

Based on frequencies, we recombined the nine types of control structure into five categories, slightly different from those used in our initial reports. We combined collegial with leader determined and shared--principal bounded discretion; the incidence of reports about the latter two occurring was low but we decided to retain both rather than eliminate them altogether because they contained information about teacher involvement in decision-making. Furthermore, the leader determined category was thought to be tapping some aspect of team-level decision making. The principal bounded discretion category was more problematic; primarily we wanted our shared typed to reflect involvement of more than a single teacher, which this category does not. It obviously fit nowhere else; the decision to include it was arbitrary and open to dispute. However, the frequency with which this category was mentioned was sufficiently low that its inclusion under collegiality did not significantly distort the meaning of collegial decision-making reflected in the category.

The three remaining shared types--teachers only, principal and teachers, teachers and nonteachers--comprised our designation of shared control structure. In each case more than a single teacher constitutes part of the input population and the output population.

The removed category remained split. The primary reason for doing this was to distinguish principal involvement as a significant decision maker from someone else who is also a nonteacher. Hence, we had the two types removed--principal and removed--other, which hereafter we simply call principal and other. Finally the teacher discretion type was left intact. The same kind of matrix array described above was produced with these five types of control structure rather than the nine.

Aggregation of Evidence

Defining Decision Issues

Our next job was to combine the evidence about decision issues into sensible groupings each of which would reflect a component of the instructional program about which decision would be made. Each of these groupings would be an aggregate of particular pieces of evidence relating to a certain decision topic and could each be characterizied as having a particular Control Structure.

In the construction of the interview, we had already identified some broad groupings which we called Decision Areas, along with Meaningful Subgroupings of issues which were reflected in the questions asked within each Decision Area. For example, "What subjects are taught in the school?" and "What subjects have you been asked not to teach?" are two different subgroupings under the task area curriculum scope and balance. In total there were 18 of these: four under curriculum scope and balance, three under

instructional materials, two under methods of instruction, two under methods of reporting student evaluations, two under methods of responding to student misbehavior, and five under grouping of students.

We immediately eliminated from consideration those issues which specifically addressed what teachers were asked/instructed not to do or use. In such cases, it was impossible for the control structure to be of the discretion type. Hence, the possibility for change in control structure over the range of types was constrained. We also eliminated an issue based on the question under grouping of students, "In which groups did subgrouping occur?".

For each of the remaining issues, we examined the total frequency of responses each piece of evidence received across all five types of control structures. We reasoned that a low frequency indicated the piece of evidence was something that did not occur in all schools. In order for our eventual index to be applicable to our sample it was necessary that the evidence pieces comprising each grouping reflect something we were reasonably sure existed in each school. For example, drama and religion were subjects mentioned with such low frequencies that we dropped them from consideration in any of the remaining issues under curriculum scope and balance.

We examined the remaining pieces of evidence in each Decision Area to determine if we could group them according to more meaningful homogeneous clusters than we presently had. Curriculum scope and balance was broken out into core and peripheral subjects, those under instructional materials were separated into textbooks and materials, field trips were distinguished from

other methods under methods of instruction used, methods of reporting student evaluations was broken out by standard and supplemental methods, the grouping for the Number of Kids Taught under grouping of students was separated into two subgroupings--one based on the presence of only one group of kids, another based on more than one. With these aggregated sets of evidence, we now had 21 issues.

Once these were formed, there occurred one more task in eliminating possible contaminating pieces of evidence within each. Generally, all bits of evidence falling under a certain grouping at T3 would show the same distribution of responses across the types of control structures, and this was expected as indicative of the integrity of our grouping of evidence. If all pieces of evidence were relating to the same grouping concept, then we would expect the dominant control structure(s) for each to be the same. In some cases we found this not to be so and such pieces of evidence were eliminated. These groupings are listed in Table 2.

Preliminary Control Structure School Scores for Decision Issues

For each grouping we calculated school scores for each type of control structure. To do this, the frequencies for each type first were summed over the bits of evidence constituting the grouping;the n's were much smaller than those used to form the groupings since they were done by school. In each wave, therefore, we were able to produce a distribution of summed frequencies across the five types of control structures. These were then converted to percentages using the total sum of the frequencies.

This procedure created ipsative scores. That is, the sum of the percents across the five types add to 100%; a change in one should be reflected by a change in one or more of the others. This dependency offered us the possibility of examining where changes in one type of control structure of a grouping would get offset by changes in another type. However, it also meant we had to exercise caution in interpreting change in any one type of control structure because of its dependence upon what happened to one or more of the other types.

TABLE 2: LIST OF DECISION AREAS

1 Subjects Taught--regular/core
2 Subjects Taught--special/peripheral
3 Lessons--regular/core subjects
4 Lessons--special/peripheral subjects
5 Scheduling--regular/core subjects
6 Schedule--special/peripheral subjects
7 Materials usually in school--other than texts
8 Materials usually in school--textbooks
9 Materials used in last four weeks--other than texts
10 Materials used in last four weeks--textbooks
11 Methods of instruction used--not field trip
12 Methods of instruction used--field trip
13 Methods of reporting pupil evaluations--standard
14 Methods of reporting pupil evaluations--supplemental

15 Frequency of use of methods of reporting pupil evaluations--standard

16 Frequency of use of methods of reporting pupil evaluations--supplemental

17 Ways used in last week to respond to misbehavior

18 Grouping--based on kids' special characteristics

19 Grouping--based on number of kids (single group)

20 Grouping--based on number of kids (2-5 groups)

21 Grouping--based on grades (single or multi-group)

Grouping Decision Issues

Decision Issue Profiles

For initial analysis purposes, we wanted to further group these 21 decision issues. In the formative stages of development of the control structure interview, an a priori categorization had been made of the more general groupings; on the basis of face validity, each grouping had been designated as dealing with an area of decision making normally about either classroom affairs or about school-wide affairs. However, we now desired a means of categorizing our newly-formed groupings in a more systematic fashion than face validity.

Our task was to determine if the 21 decision areas clustered into a few discrete and meaningful categories. If they did then we would aggregate percentages across the decision areas that fell under each broader category. The aggregated percentages for each type of control structure would then characterize to these broad decision areas.

The resulting clusters had to be representative of our sample of schools. It was therefore logical to include information from all our experimentals and controls and to use the T3 data again. In addition, our characterization of each decision issue for this purpose had to preserve as much relevant information as possible about the nature of the five control structures. The most sensible solution was to depict each issue by a profile showing the frequencies with which each of the five types of control structures occur. Thus, we ended up with 21 profiles each showing the frequencies of respondents in all schools reporting each type of control structure for each particular decision issue.

Our problem, then, evolved into one of determining how to cluster the issues in terms of their profiles, but any such kind of profile analysis first required some type of measure of similarity between pairs of profiles. In order to select an appropriate measure/index of similarity we had to determine the relevance of three characteristics of profiles--level, dispersion, and shape. Nunnally (1967) points out that the nature of the index will differ depending upon which are considered important in determining the similarity or difference between any pair of profiles. We wanted to compare profiles on the basis of which control structures the majority of respondents indicated characterized each one.

Similarity in the average frequency across the five control structure types (i.e. similarity in the levels of profiles) offered us little interpretive power. We were not interested to know if the frequencies for the control structures were generally about the same size for one decision area

compare to another--that merely indicates something more about the incidence of issues in those decision areas than about their control structures. Nor were similarities in how widely those frequencies diverged from the average (i.e. similarities in the dispersions of profiles) crucial to our interests; we were not convinced about the relevance of knowing that decision areas were or were not similar in their variation across the control structure.

Similarity in the shapes of the profiles, however, did seem to be relevant; that is, regardless of differences or likenesses in levels and dispersions, for which types of control structures the high and low frequencies occurred was meaningful. Similarity in shape in this respect is concerned with the similarity in the rank order of the frequencies for control structure types for any two decision areas being compared.

Consequently we settled upon using correlations between profiles because they are measures which are sensitive to differences to similarities in form/shape but which standardize the level and dispersion in all profiles compared (and thereby ignore differences of similarities in those features).* We were aware that a problem existed in the fact that a correlation between any two profiles would be based on an n of only 5. This led us to search for a clustering technique that would not be overly rigorous in its assumptions about the properties of the similarity data it uses.

Clustering Profiles: Multidimensional Scaling

Nunnally (1967) discussed three methods for clustering profiles. One is

*See Appendix A: Profile Similarity

discriminatory analysis, a procedure which attempts to discriminate between a priori designated groups on the basis of their profiles on a variety of variables. We were not convinced the decision areas should be clustered into a School vs. Classroom dichotomy at face value; indeed, we suspected more relevant grouping criteria would be on more dimensions than one and the meaningful clustering into more groups than two. At this point in the analysis we were not prepared to specify confidently such groupings of the areas.

We toyed with Factor Analysis, another of Nunnally's suggestions, but the nature of our correlational data made us leery of the applicability of the technique from the start. Once we did attempt an actual factor analysis using SPSS (Statistical Package for the Social Sciences) but the run aborted because the inverse of the matrix could not be computed.

We decided to use Nunnally's last suggestion, Multidimensional Scaling. The general multidimensional scaling procedure generates a spatial representation in x dimensions of the relationship among objects; in this case, an object is a profile for a decision area. The method provides one with a small number of dimensions needed to account for the similarities among the profiles and coordinates of each profile on each dimension. The set of coordinates locate the profiles with respect to one another; that is, each profile is represented as a point, similar profiles are close together, and dissimilar ones are far apart.

Although the basic data input to the multidimensional scaling was correlational, the particular program we used is a nonmetric method that accepts metric data; however, in its treatment of that metric data it does

not subject it to rigorous metric assumptions about the nature of the relationship between the index of similarity (correlation) and actual similarity, nor about there being a normal distribution of such correlations in the population.

Our similarity indices were correlations between profiles. We realized that one problem with this was that each was based on an n of only 5. We used the MINISSA-I(M) multidimensional scaling program which is based upon works of Guttman (1968) and Lingoes (1965, 1966, 1967, 1968, 1971) and Roskam (1970). (The authors note it is equivalent to SSA-1 and replaces SSAR-1 & MSA-I

Input was the correlations among the 21 decision areas presented in Table 3. The numbers refer to the decision areas in Table 2. We limited the maximum number of dimensions to three and requested the program to minimize Kruskal's Stress.*

Figure 1 depicts the final configuration in two dimensions. The coordinates for the 21 decision areas are in Table 4. As can be seen, the configuration had a Stress value of .05. A solution was also generated for three dimensions with a Stress of .01; no solution was generated in one dimension. With a low Stress value of .05, the solution in two dimensions was the most appropriate to use. Figure 2 depicts prototype profiles for the three groupings in Figure 1; the Areas are described further in the following text.

Normally, the output configuration of a multi-dimensional scaling program is not immediately meaningful and further analyses are often in order to interpret the results. Often transformations such as axis rotation are applied but other approaches were more amenable to our data. Subkoviak

*See Appendix B: Multidimensional Scaling.

TABLE 3: Correlations Among Decision Areas

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1																					
2	.97																				
3	-.33	-.12																			
4	-.30	-.08	1.00																		
5	-.33	-.11	.97	.98																	
6	-.30	-.08	.99	.99	.95																
7	-.54	-.58	-.26	-.23	-.08	-.27															
8	.73	.56	-.87	-.85	-.82	-.87	-.06														
9	-.36	-.16	1.00	.99	.95	.99	-.29	-.89													
10	-.28	-.08	.99	.98	.93	.99	-.37	-.85	1.00												
11	-.35	-.14	.99	.98	.93	.98	-.32	-.88	1.00	1.00											
12	-.47	-.26	.98	.98	.98	.96	-.09	-.91	.97	.95	.97										
13	.94	.85	-.58	-.56	-.60	-.53	-.44	.85	-.60	-.52	-.58	-.71									
14	-.34	-.14	.98	.96	.90	.97	-.38	-.87	.99	.[illegible]	1.00	.94	-.56								
15	.97	.94	-.38	-.35	-.39	-.33	-.46	.72	-.42	.4	-.41	-.53	.96	-.40							
16	-.32	-.11	.99	.98	.93	.98	-.36	-.86	1.00	1.00	1.00	.96	-.56	1.00	-.38						
17	-.33	-.13	.99	.97	.91	.98	-.37	-.87	.99	1.00	1.00	.95	-.56	1.00	-.38	1.00					
18	-.47	-.52	-.31	-.29	-.11	-.36	.96	.05	-.34	-.42	-.38	-.13	-.40	-.44	-.44	-.41	-.43				
19	-.25	-.24	-.48	-.48	-.53	-.39	.42	.16	-.48	-.50	-.49	-.48	.13	-.48	.07	-.50	-.46	.20			
20	-.40	-.44	-.33	-.30	-.15	-.32	.98	.04	-.37	-.44	-.40	-.18	-.28	-.47	-.29	-.43	-.44	.91	.52		
21	-.42	-.53	-.37	-.41	-.50	-.31	.28	-.04	-.34	-.36	-.33	-.37	-.12	-.29	-.24	-.34	-.29	.09	.88	.31	

TABLE 4

MULTIDIMENSIONAL SCALING FOR CONTROL STRUCTURE DECISION AREAS--TIME 3

GUTTMAN-LINGOES' SMALLEST SPACE COORDINATES FOR M = 2 (SEMI-STRONG MONOTONICITY)

DIMENSION	1	2	
VARIABLE			
1	60.112	100.000	121.384
2	46.610	-98.746	112.372
3	-94.541	-9.634	78.736
4	-91.617	-7.923	75.740
5	-89.264	2.433	73.759
6	-89.310	-13.752	73.866
7	45.256	89.270	112.699
8	90.914	-56.567	118.464
9	-97.445	-11.897	81.785
10	-95.326	-16.271	80.149
11	-97.813	-13.805	82.326
12	-97.547	-0.335	81.782
13	78.610	-87.420	125.167
14	-100.000	-18.110	85.088
15	67.402	-93.236	121.084
16	-97.264	-15.581	81.981
17	-98.724	-16.790	83.586
18	39.229	100.000	118.937
19	85.046	36.128	109.165
20	54.471	86.348	115.623
21	85.901	55.898	118.838

GUTTMAN-LINGOES' COEFFICIENT OF ALIENATION = 0.06070 in 50 ITERATIONS.
KRUSKAL'S STRESS = 0.04842
G-L's PHI FOR LOCAL MONOTONICITY = 0.00149

FIGURE 1:
VECTOR PLOTS FOR MULTIDIMENSIONAL SCALING RESULTS

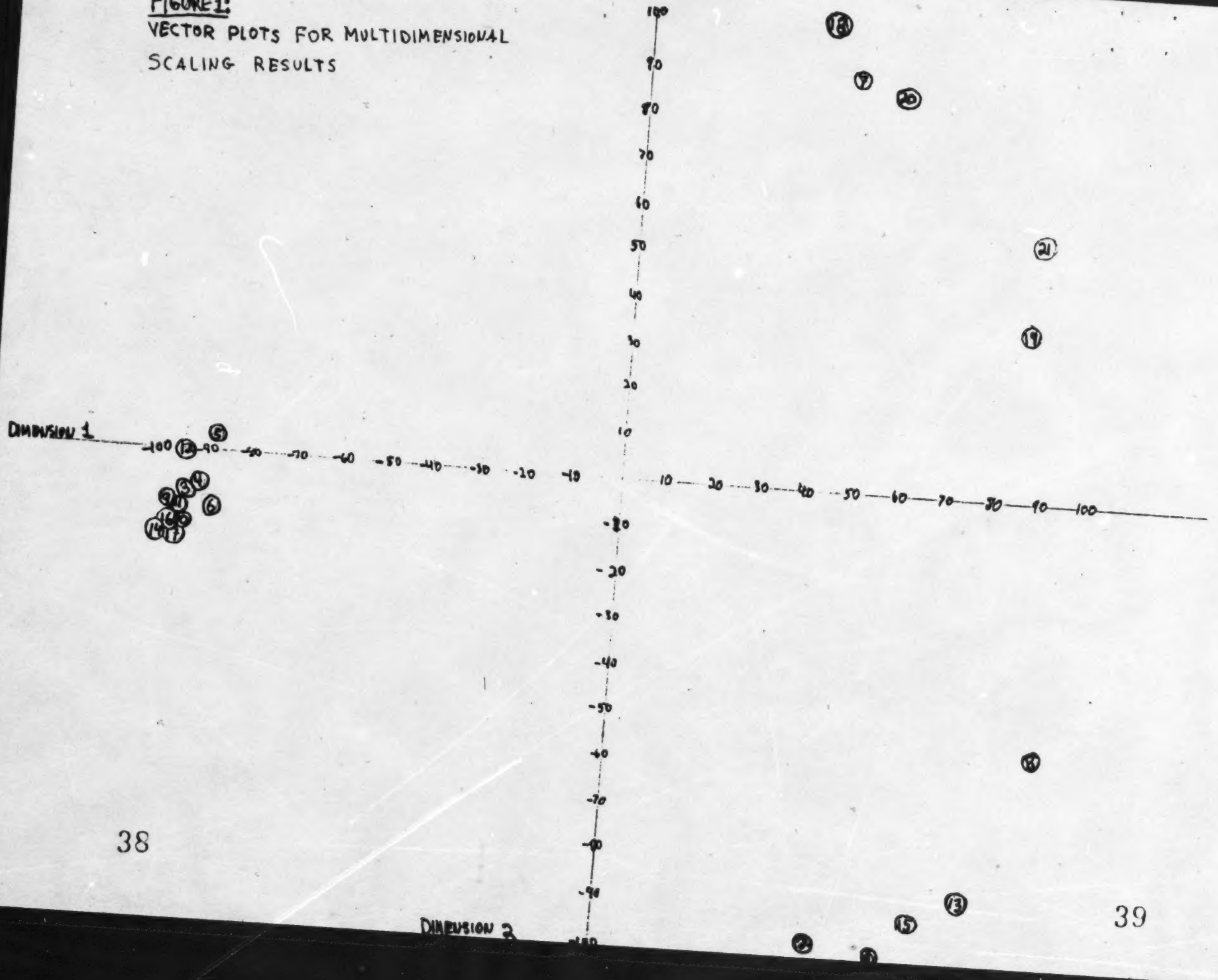
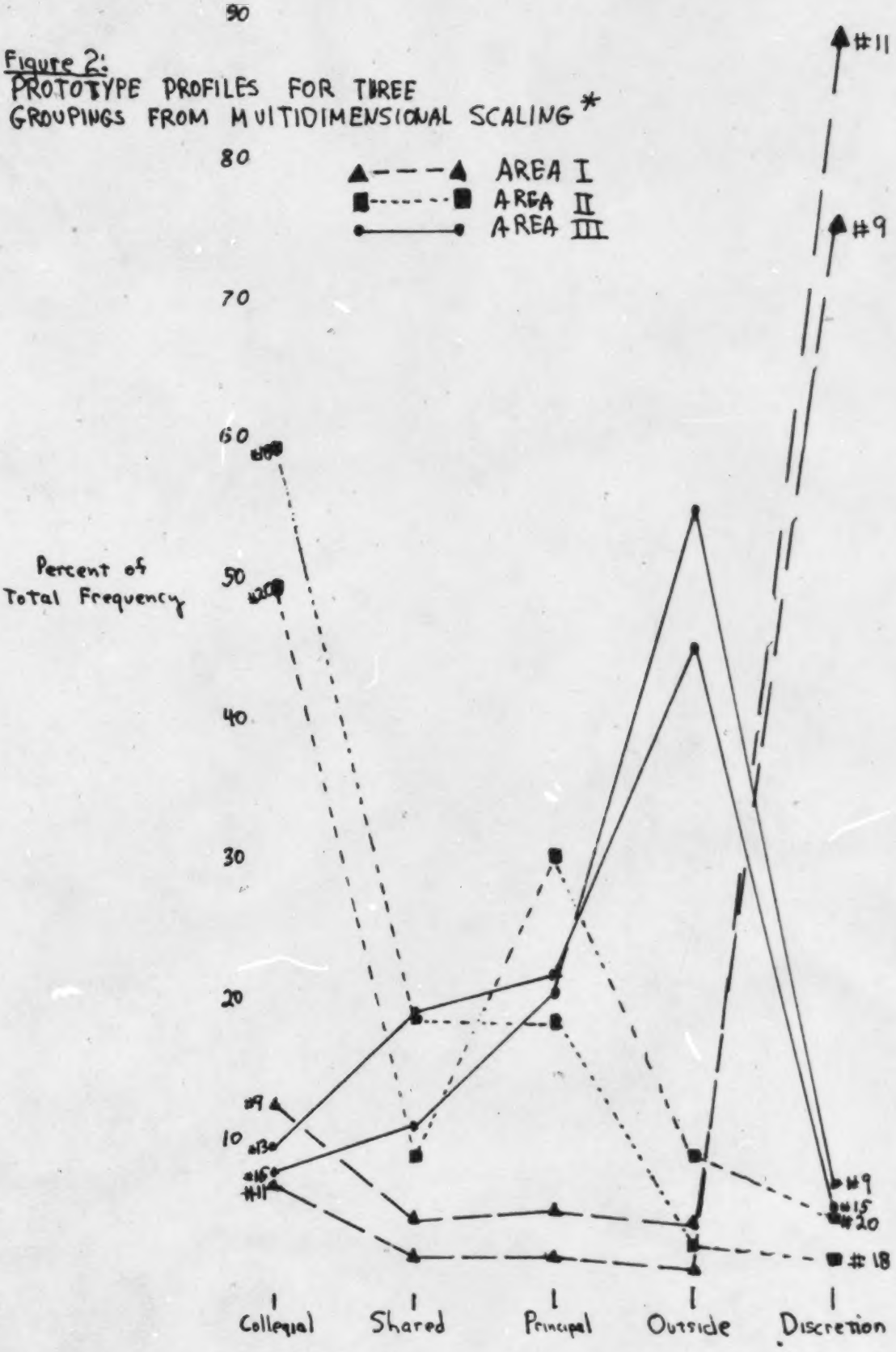


Figure 2:
PROTOTYPE PROFILES FOR THREE GROUPINGS FROM MULTIDIMENSIONAL SCALING*



* Numbers by each plot refer to selected exemplary decision issues.

(1975) notes that the basic approach to making the configuration interpretable is to bring to bear a variety of information about pertinent properties. He describes two approaches: internal and external analyses.

In internal analyses, one attempts to make some sense of the groupings at face value based on knowledge of the properties of the decision areas--what do the areas hanging together have in common and how do they differ from other clusters? In external analysis, one brings to bear some external information about the groupings to determine if the clusters behave/relate to other variables according to expectations. Much of the data to follow was drawn from several working papers written by W.W. Charters; these are listed in the references.

Internal Analysis: Post-Multidimensional Scaling Final Clustering

For our internal analysis, we examined the three general clusters that appeared in the final configuration and attempted to assess properties common to the decision areas within a cluster and the differences between clusters. We did re-classify one decision area into another cluster--#7, Supplementary Materials in the School, was clustered with the decision areas which generally related to instructional organization. Otherwise, the clusters were kept intact.

Clusters

Area 1: Instructional Processes Issues

#	Decision Area
3	Lessons for Core Subjects
4	Lessons for Peripheral Subjects
5	Scheduling for Core Subjects
6	Scheduling for Peripheral Subjects
7	Supplementary Materials in School
9	Supplementary Materials used in last 4 weeks
10	Textbooks used in last 4 weeks
11	Methods of instruction
12	Fieldtrips
14	Supplementary Methods for reporting student evaluation
16	Frequency of reporting student evaluations
17	Responses to student misbehavior

Area II: Deployment Issues

#	Decision Area
18	Grouping on basis of special characteristics
19	N of students in Group 1
20	N of students in other groups
21	Age-grade grouping of students

Area III: Systemic (District Policy) Issues

#	Decision Area
1	Core subjects taught in school
2	Peripherial subjects taught in school
8	Textbooks in school
13	Standard methods of reporting student evaluations
15	Standard methods of reporting student evaluations: frequency of use

Some of the decision issues were recombined and others dropped resulting in a total of 13 rather than 21 decision areas, and these formed the basic decision areas from which school scores (percentages) were calculated.

In Area I, the decision areas relating to the peripheral subject areas were dropped completely (#4 and #6) primarily due to their relatively low frequencies compared to the core subject areas. Fieldtrip (#12) was combined with the other Methods of Instruction (#11) because their control

structure distributions were essentially alike. The decision areas relating to Supplemental Reporting Methods (#14) and the Frequency of Use (#16) were combined for the same reason. This left eight decision areas comprising Task Area I.

In Area II the age-grade grouping decision area (#21) was split into that applying to cases with a single group and that for the more than one groups (2-5). Then the age-grade grouping for the single-group case was combined with the decision area for the number of students in that group (#19), and the age-grade grouping for several groups was combined with the decision areas for the number of students in the several groups (#20) and grouping on the basis of special characteristics (#18), which applied to single and multi-grouping. This gave two decision areas for Task Area II, one dealing with instances of a single group exclusively and the other dealing with multi-group characteristics.

In Area III standard reporting methods (#13) and their frequency of use (#15) were combined because their control structure distributions were essentially alike. Peripheral subjects taught in school (#1) was dropped for the same reason as in Area I. This left three decision areas comprising Area III.

The final picture of the task areas, the decision areas comprising them, and the pieces of evidence comprising the decision areas is presented below.

Area I: Instructional Processes Issues

Decision Area	Evidence
1. Lessons presented for Core subjects	Spelling, reading, other LA, Math, social studies, science

2.	Scheduling for core subjects	(same as #1)
3.	Supplementary materials in school	Workbooks, other books, programmed materials, AV equipment, AV materials, construction materials, construction tools, games and puzzles.
4.	Materials used in last 4 weeks	Textbooks
5.	Materials used in last 4 weeks	(same as #3)
6.	Methods of instruction	Lecture, recitation, group discussion, question-answer, AV presentation, individual instruction, games/contests, independent study, projects, small group instruction, programmed learning, field trip.
7.	Supplemental methods of reporting student evaluations and frequency of use	Special note, special conference, telephone conference
8.	Responses to misbehavior	Withdraw privilege, scolding note to parents, cousneling, parent conference, send from class, detain after school, detain during recess, separate from class, threaten with above

Area II: Deployment Issues

1. Single group taught--number of students and age-grade grouping
2. Multi-groups taught: grouping by special characteristics, number of students and age-grade grouping

Area III: Systemic (District Policy) Issues

1.	Core subjects taught in school	Spelling, reading, other LA, math, special st., science

2.	Materials used in school	Textbooks
3.	Standard methods of reporting student evaluations and frequency of use	Report cards, parent conference

Control Structure Scores on File: Basic Data Analysis Scores

For each of these 13 decision areas, school scores at each wave were calculated for each of the five types of control structures--these were expressed as percentages of the total frequencies. The sum of these percentages across the five control structure types equalled 100%. We also aggregated percentages across the decision areas comprising each task area to get scores for each school for the three task areas by wave; finally, we aggregated across the three task areas to form composite scores for each type of control structure. This, then, constituted the nature of the control structure information on file for use in subsequent analyses.

External Analysis

As a first part of our external analysis, we examined the general control structure distributions for these three areas. The graph comparing these areas over 27 schools--14 surviving experimentals (through T5) and 13 controls--and averaged over five waves revealed distinctive decision-making patterns characterizing each. Figure 3 compares the control structure distributions for the three areas averaged over all schools and waves to give a general picture of their distinctive decision-making patterns. To the far right is the composite of the three areas.

FIG A

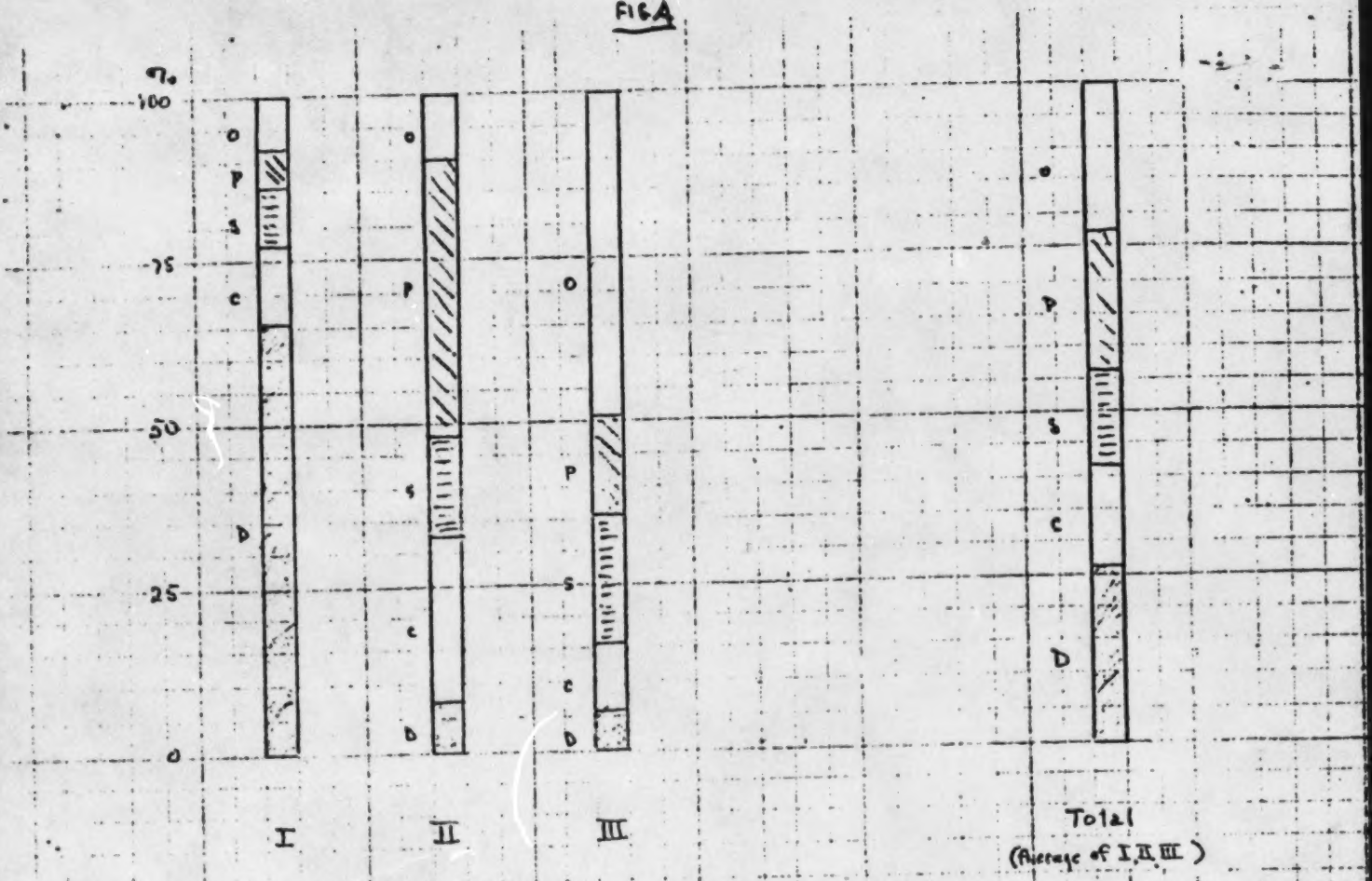


FIGURE 3: Control Structure - Comparison of Three Task Areas overall waves

KEY

O		Outside
P		Principal
S		Shared
C		Collegial
D		Discretion

Area I appeared to deal with classroom or instructional process issues normally left to the discretion of individual teachers. Area II dealt with more general school-wide issues about organizing or deploying students for instruction and normally resolved by the principal or the principal along with teachers. Area III dealt with broader district-wide or systemic issues normally resolved outside the school building or sometimes, depending upon the degrees of district decentralization, within the school by the principal or the principal along with teachers. Obviously the aggregate conceals a great deal of variation between the areas.

It was reasonable to expect that decisions made in Area III dealing with district policy decision areas, not only be made predominantly by persons outside the school but also be tied to some enduring school district characteristics. It was further possible that the decisions made in Areas I and II by persons outside the school would also be tied to district characteristics, under the assumption the outside decision maker was someone in authority at the district level.

Two different ANOVA's were run using district as the grouping variable and the percent of decisions made in the Outside type of control structure averaged over the five waves as the dependent variable. One ANOVA was done using a composite score across the three task areas and another was done for Area III only. We used ten districts, omitting those having only one school in our sample and one which had missing or irrelevant data. The results revealed a strong district effect for the composite score ($w^2 = .53$) and a stronger one in Area III ($w^2 = .68$).

We examined the data further to determine what district characteristics may have accounted for the variation in the five-wave average percent of district policy decisions made outside the school. Since this analysis was correlational, the findings are tentative due to the small n on which they were computed.

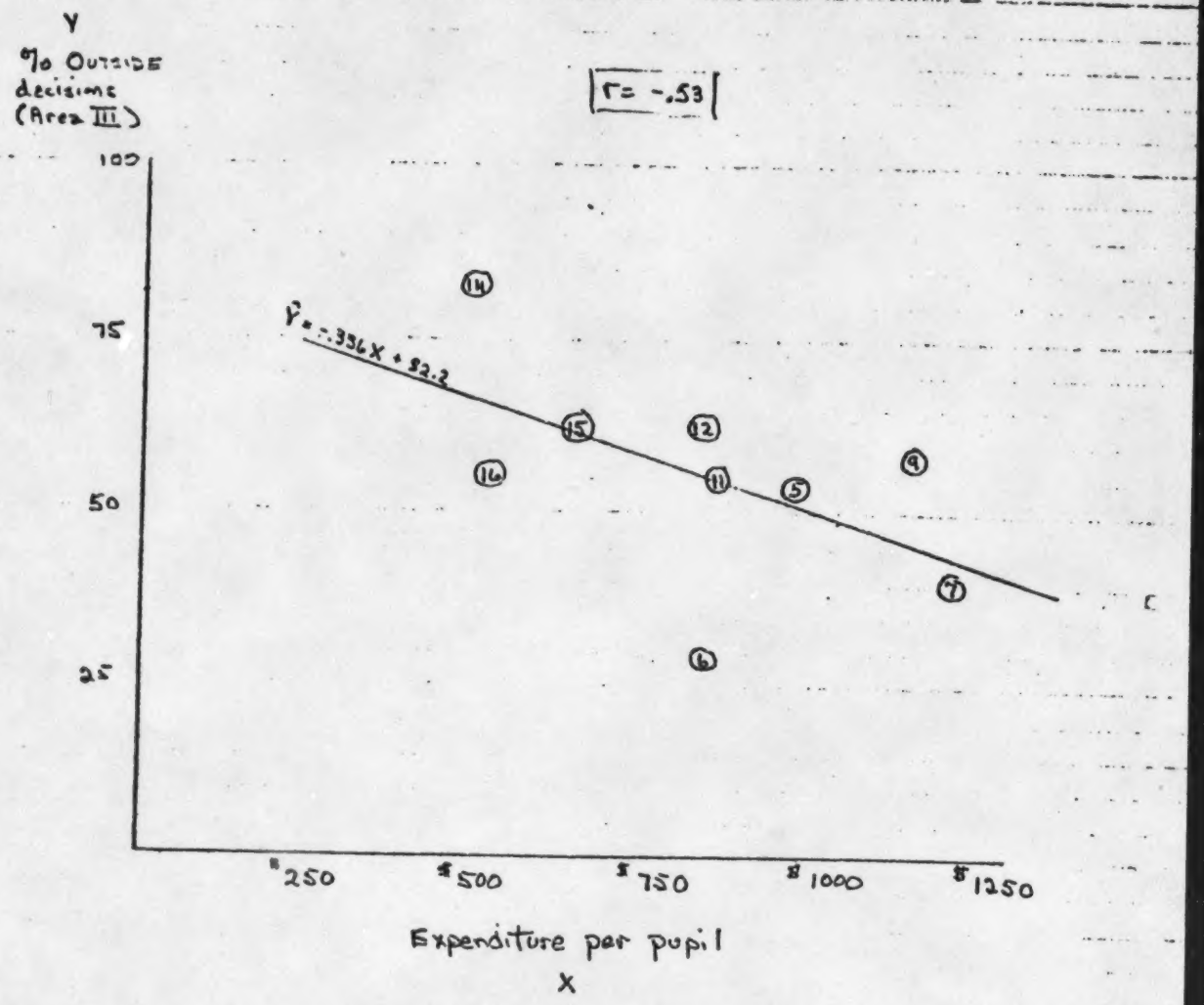
We looked at three district characteristics: per pupil expenditure (district wealth), the number of administrative levels, and district size. The variation in the number of administrative levels, however, was too small to permit a convincing systematic analysis. The variable took on values of only 2, 3, and 4 and just one district reported 2. Per pupil expenditure revealed a substantial correlation of -.53 with the percent of Area III decisions made outside the school--the wealthier the district, the fewer the district policy decision made outside the school . This relationship is plotted in Figure 4.

We had three indicators of district size: number of students, number of elementary teachers, and number of elementary schools. We chose to use the number of elementary schools, converting the values to logs to help normalize their distribution. The zero-order correlation with percent of Area III decisions made outside the school was essentially zero. However, when we removed the effects of wealth from the percentage scores and correlated the residual percentage scores with the number of elementary schools, the resulting semi-partial correlation equalled -.50.

In sum, both district wealth and size appear to be inversely related to the average proportion of Outside decisions in Area III. The wealthier

FIGURE 4:

DISTRICT DETERMINANTS OF OUTSIDE DECISIONS -- EXPENDITURE PER PUPIL



and the larger the district, the smaller the proportion of Outside decisions in that area where decisions normally are settled outside the school. These data could be interpreted as reflecting variations in the centralization-decentralizaton dimension of school districts.

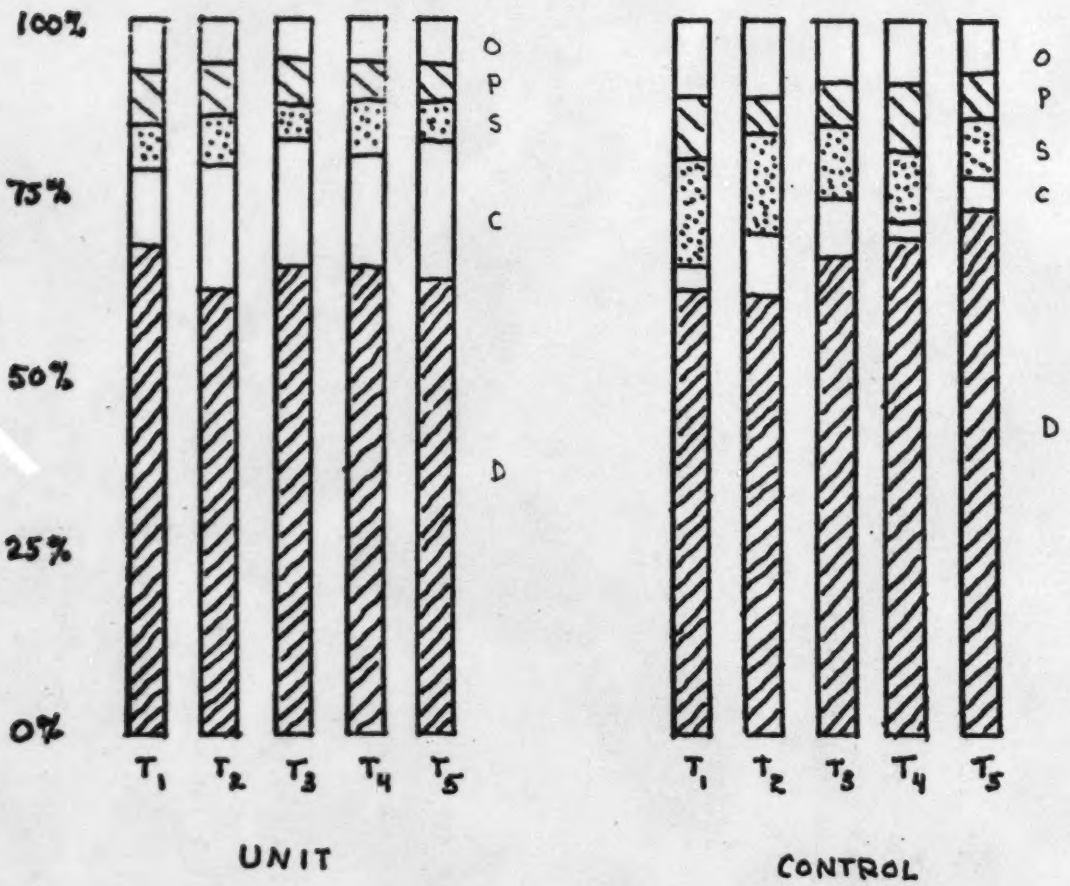
Because of the nature of the decision areas in Areas I and II, we suspected that the scores for the dominant type of control structure in each--Discretion in Area I and Collegiality in Area II--would not differ markedly by district. We essentially wanted to convince ourselves that these were a function of forces within schools rather than activities peculiar to districts. We ran one-way ANOVA's paralleling that in Area III using district as the grouping variable and percent of decisions made collegially in Area II and at the teachers' discretion in Area I. We found no district in either area (a slight nonsignificant one appeared in Area I; $F=1.85$, $df=9/16$, $p=.14$, $w^2 = .28$). This lent further credence to our separation of Area III from Areas I and II.

We wanted to further examine the utility of the three areas by looking at the effects of unit organization on control structures in each area. In order to examine trends in the experimental school it made sense to examine those in control schools first. The following figures present the aggregated information for experimentals and controls by each wave for the three areas and the composite* (Figures 5-8).

*By virtue of our successive aggregation procedure in constructing these graphs, the summed percentages over the five types of control structure do not always equal 100%; where substantial departures occurre, the graphs were adjusted so they would sum to 100%. Such cases are indicated by an asterisk. (For example, if the sum were 105%, the other percentages were multiplied by the reciprocal of 105.)

Figure 5: CONTROL STRUCTURE

AREA I



O = Outside
P = Principal
S = Shared
C = Collegial
D = Discretion

Figure 6: CONTROL STRUCTURE

AREA II

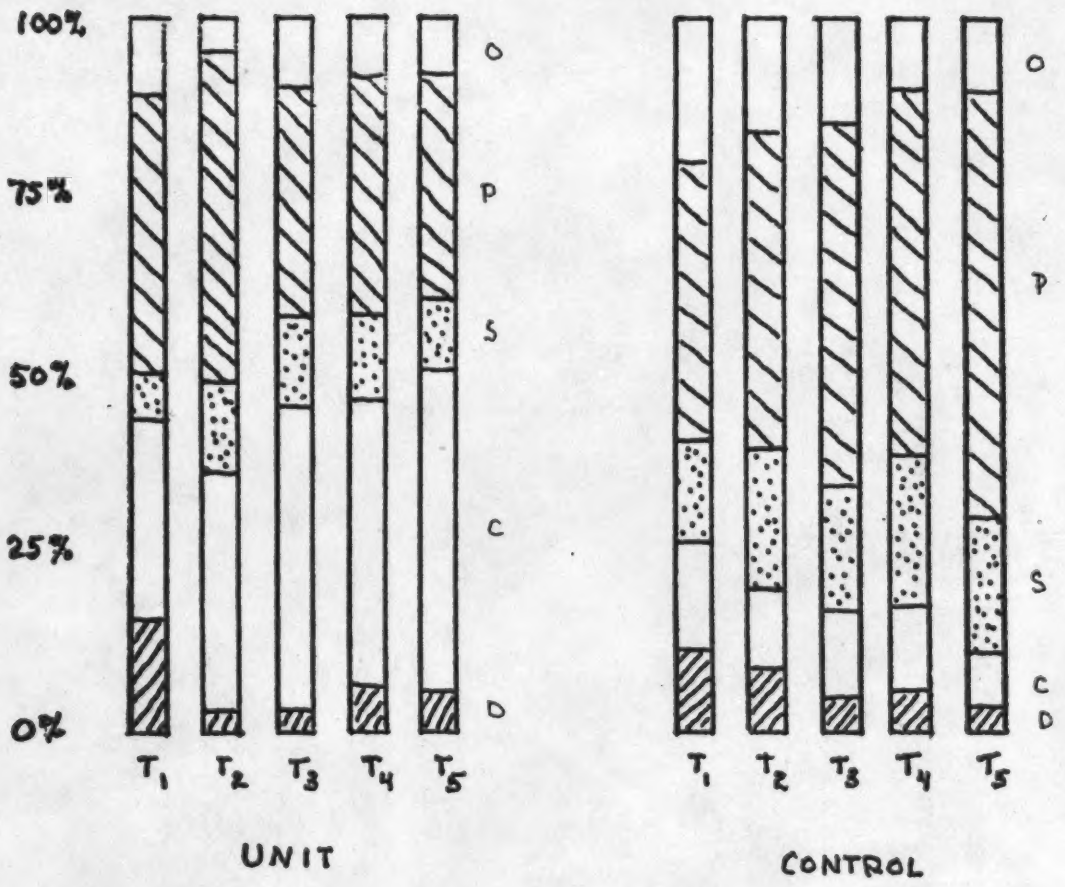
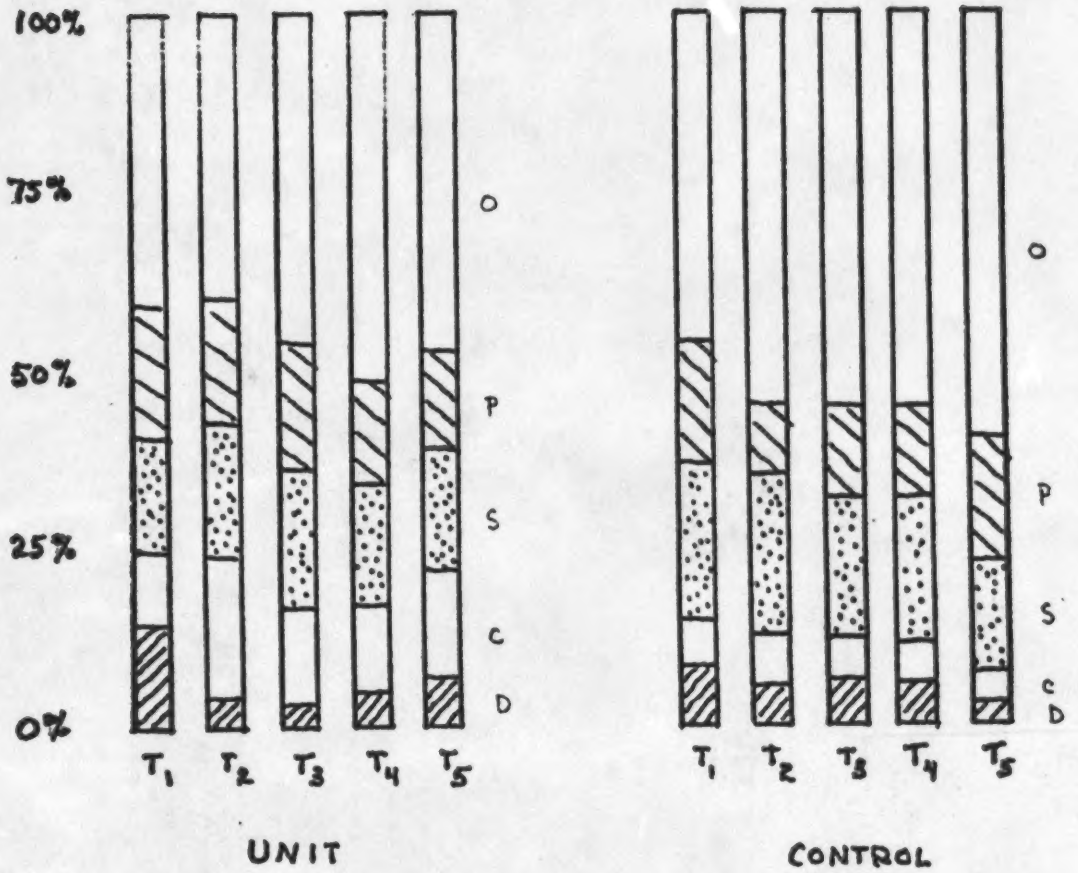


Figure 7: CONTROL STRUCTURE

AREA III



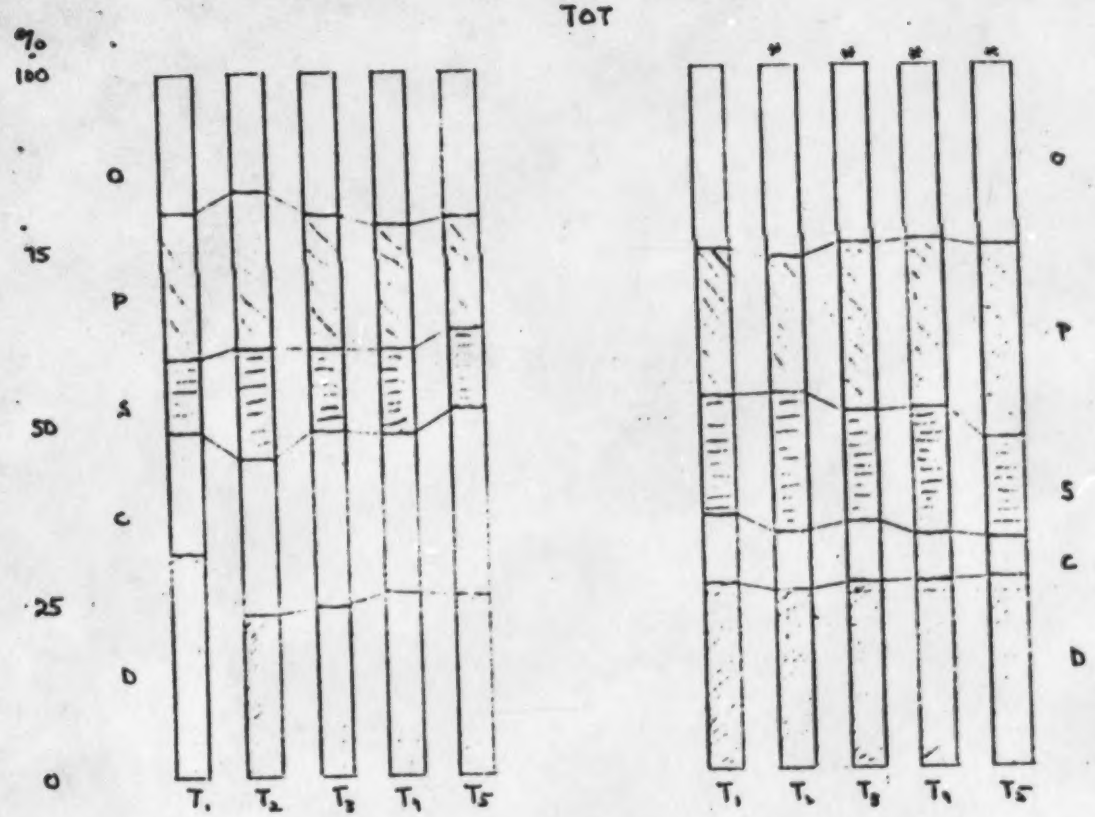


FIGURE 8: Control Structure - COMPOSITE DISTRIBUTION

The composite suggests a regular increase in the proportion of decisions in which the principal is involved; that is, a combination of principal and shared control structure types. The separate Areas give a different picture, however. The dominant type of control structure within each area becomes more dominant through time at the expense of the other four types. Discretion increases in Area I, Principal (and Shared) in Area II, and Outside in Area III.

We were unable to explain this control school phenomenon. It may have been an instrumentation artifact, respondent fatigue, shortcuts taken by interviewers, coding errors, something attributable to outlier schools or to novel characteristics in a few schools, such as new principals settling in to their roles.

We next compared the experimentals and controls at T1, a point in time prior to the formal establishment of units in the innovative schools. The composite and each area separately revealed control structure differences between experimentals and controls. Both Collegial and Discretionary decision making was greater in the experimentals; decision making by individuals outside the school, in addition to that implicating the principal, was greater in the controls.

A couple of possible explanations may account for these observations. One is that the schools where a high degree of Collegial and Discretionary decision making existed beforehand may have been the only ones amenable to installing this type of innovation. Another is that the initial decision-making activity to install the innovation, about four-five months prior to

our T1 measures, plus preparatory "gearing up" activities in the interim may have altered the previously existing control structure. If this were true, we would not expect to see much difference between experimentals and controls in Area III since the preparatory activities within experimental schools would not be expected to influence the nature of decision making in matters of district policy. The data indeed suggests that the experimental-control differences in this area were less pronounced, lending support to the latter explanation.

Now we can examine the through-time trends in the experimental schools. The composite shows a clear increase in collegial decision-making, contrasting sharply with the control-school trend; this trend is most pronounced in Area II and least in Area III.

Considering Area II, the increase in collegiality is more generally an increase in the implicaton of teachers in the decision process (Collegiality plus Shared). It comes at the expense of Discretion, on the one hand, and of decisions made by the Principal alone. An interesting and meaningful exception occurs at T2 when the principal, either alone or in the Shared mode, has a big hand in the decision process--perhaps to help get things under way.

The trends in Area I are much the same as II, although not as strong. Discretion suffers, as does the Principal alone, in the face of increasing Collegiality and Shared decisions. The principal does not enter big at T2, though, as s/he did in Area II.

Area III trends are not very clear in the experimental schools and must be deciphered by examining the way they compare with control school trends. One thing is clear: the experimental schools did not noticeably gain a favored status in which they were buffered from district policies and decisions.

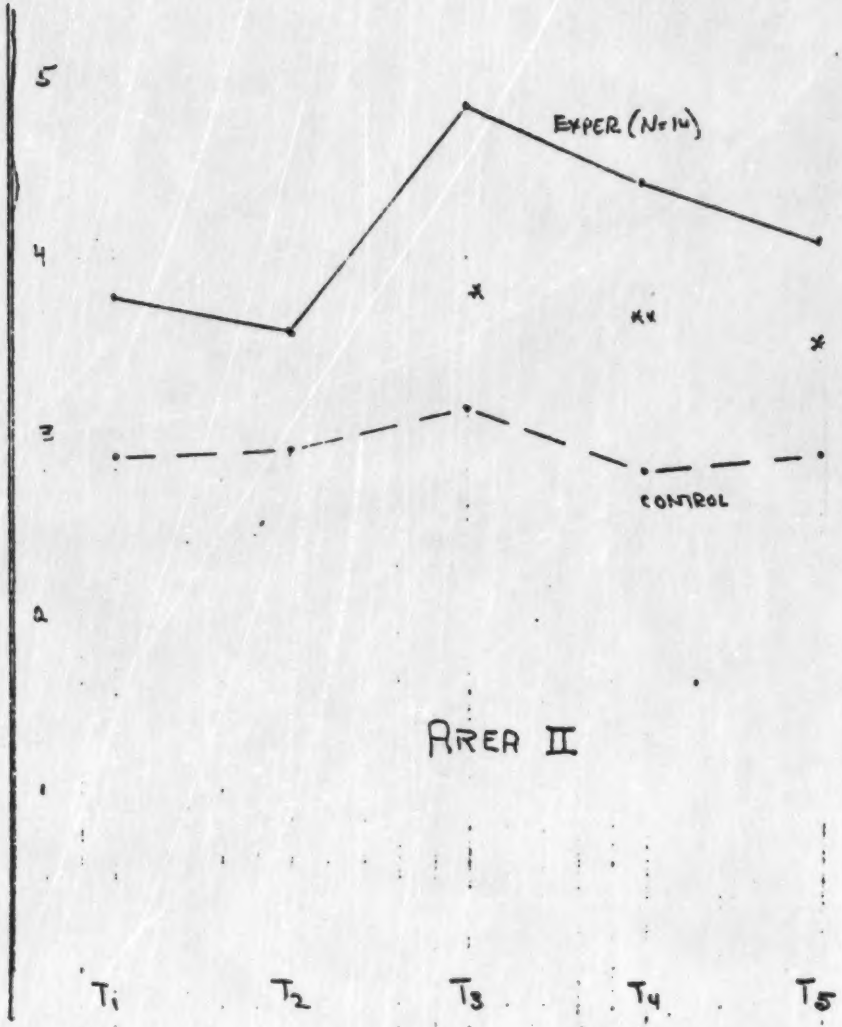
Another piece of information pertaining to experimental-control differences in Areas I and II exists in the absolute number of decisions per informant over time. Figure 9 shows significantly larger numbers of decisions per informant over time. The attached graph shows significantly larger numbers of decisions for experimentals than controls at T3, T4 and T5 in Area II but no differences in Area I. A regression of T5 frequency on a dichotomous variable distinguishing experimental from control schools, and controlling first for the T1 frequency confirmed the observation (N = 27). The data are:

	Beta	R^2	R^2 Change	F	
Task Area I					
T_1	.455	.210	--		
EXPCON	.212	.255	.045	1.428	n.s.
Task Area II					
T_1	.394	.254	--		
EXPCON	.326	.348	.094	7.465	p=.012

This indicates, along with our earlier analyses, that not only did the proportion of collegial decisions expand in the unitized schools, their absolute number increased even more.

These preliminary analyses of the control structure data suggested the distinction among the three domains had a useful implication for later

AREA I



AREA II

FIGURE 9: NUMBER OF "EVIDENCES" PER INFORMANT

t-test
* Signif. < .05
** Signif. < .01

analyses. Area III reflected issues for which decision were predominantly made at least by individuals other than teachers and quite often by persons outside the school altogether. It allows an examination of degree of centralization-decentralization in the district on matters normally implicating district policy.

The distinction between Areas I and II also allows us to pursue interesting possibilities; for example, that the experimental schools took one of two alternative directions in implementing the IGE/MUS model: emphasizing curriculum and instructional change (the IGE part) or emphasizing alteration in the organization of instruction (the MUS part). In some schools Collegiality may increase in Area I but not in II, while in other schools, it may be the reverse--an easily examined possibility.

Several other preliminary analyses suggested that the Collegial scores in Areas I and II relate to outside variables in about the same way. This is to be expected, especially at T4 and T5, where the two themselves are highly correlated. The within-wave correlations substantially and regularly increase from T1 to T5.

Wave	r I-II (Collegiality)
1	.36
2	.38
3	.49
4	.61
5	.71

Whether this is a phenomenon of the experimental schools only we could not say. If it is, it would suggest that the units gradually got their act

together and extended control over both classroom-curriculum and instructional organization areas.

This phenomenon suggested that, for some analyses studying the Collegial control structure, Areas I and II be combined. In one such analysis, the Collegial scores for Areas I and II were averaged for each school at T1 and T5. Three regressions were run for Areas I, II and their composite; T5 was the dependent variable, T1 was a covariate, and a dichotomous variable distinguishing experimentals (coded 1) from controls (coded 0) was the independent variable. Interestingly, unitization showed a stronger effect on the combined Collegiality score at T5 than on the scores for the two areas separately. Beta weights for the latter were .664 and .662 respectively and .727 for the composite. This suggested the composite values give a better fix on what happens to Collegiality as a result of unit organization than the two areas separately.

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APPENDIX A : Profile Similarity

Nunnally (1967) notes that in order to select an appropriate similarity measure one must consider the relevance of the information provided by three basic characteristics of profiles--level, dispersion, shape. A profile is normally viewed as applicable to individuals across a number of variables; in our case it applies to individual decision areas across five types of decision areas. The level of profile is the average score across all variables--in our cases it would be the average frequency across the five control structure types. The dispersion of a profile describes how widely scores in a profile diverge from the average (level); in our case this would amount to a standard deviation of the frequencies around the mean frequency in each decision area. The shape of a profile describes where the highs and lows occur; in our case for which particular control structure types do the "ups" and "downs" occur in each decision area? Shape is defined by the rank order of the types of control structure for each decision area.

If all three are considered meaningful as a basis for clustering profiles, they should be allowed to vary during analysis. One of the more appealing measures of profile similarity that allows for this is the distance measure, D, which is based on the generalized Pythagorean theorem for the distance between two points in Euclidian space. For any j number of variables in a profile, the D for the profiles of two individuals a and b is given by:

$$D_{ab} = \sqrt{\epsilon (X_{aj} - X_{bj})^2}$$

However, Aurally states it is inappropriate to use D with techniques geared to clustering of several profiles; it is better to use cross products. In order to use them, the raw scores must undergo some form of transformation depending if one wants the analysis sensitive to differences among profiles in level, dispersion, and/or shape.

He immediately notes it is difficult to find a transformation suitably sensitive to all three. If level is deemed irrelevant, then one can use deviations about a profile's level as the basis for computing cross-products; if these are divided by the number of variables, then one would obtain the covariance betwen the profiles and the analysis would proceed using them. If differences in level and dispersion were deemed irrelevant, then one can compute correlations between profiles, which essentially equates the means at zero and the standard deviations at one.

APPENDIX B: Multidimensional Scaling

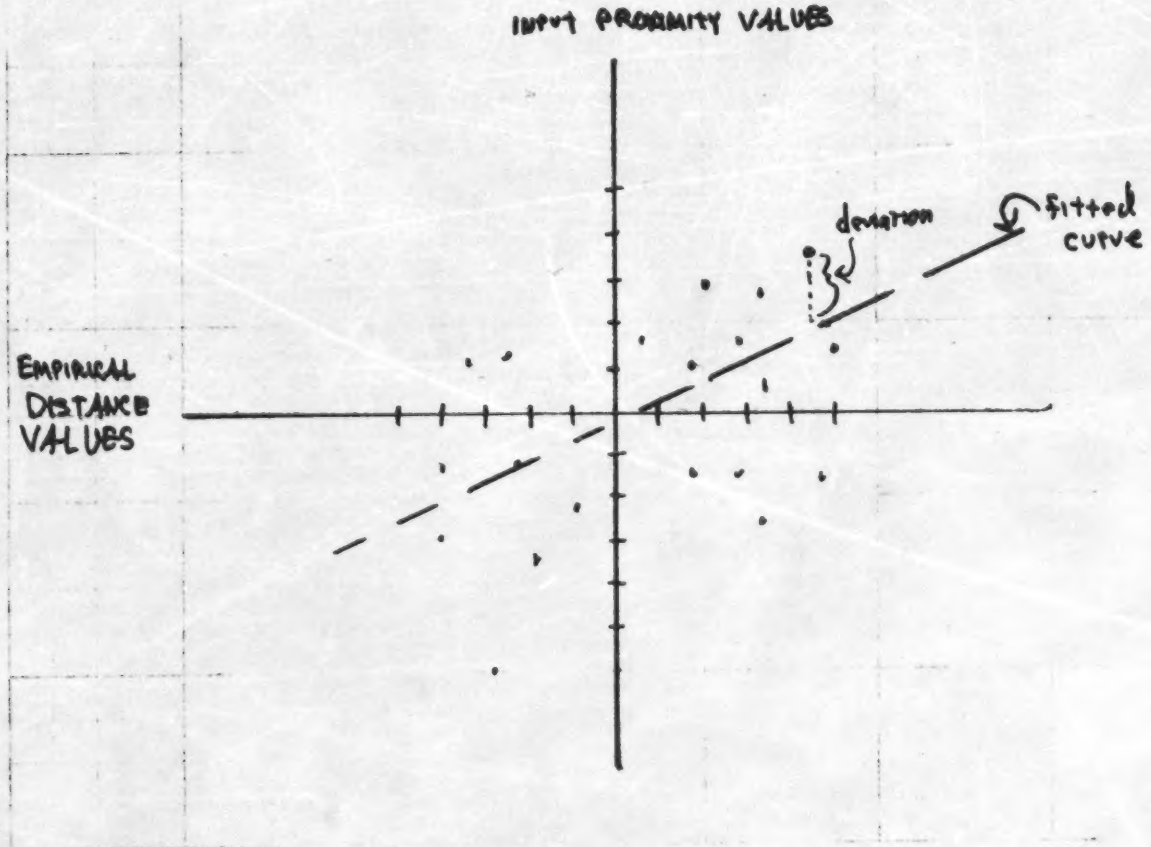
The program MINISSA-I employs a procedure akin to that of the Shepard-Kruskal method.

The proximity values input to the program, correlations in our case, are ranked low to high; as will be seen this ordering acts as a basis for generation of a unique arrangement of the 21 decision areas. As an example of the procedure, assume the number of dimensions needed to characterize the proximity values for the decision areas is two. The program begins with an arbitrary arrangement of the decision in two dimensions, computes distance values between each area in this configuration, and then ranks the distance values in ascending order. This ranking is compared with that for the original proximities input to the program to produce a Stress value which reflects the extent of agreement in the two orderings. The lower the Stress, the better the agreement--a desirable end.

If the Stress value is unsatisfactorily high, another configuration is arranged so as to decrease the stress. Most simply put, if the Stress is too large, points are moved closer together. Distance values are again calculated for the new configuration, rank ordered, and the ordering compared with the ordering of the input proximity values to produce another Stress value.

This process is repeated through a number of iterations until a two-dimensional configuration results whose Stress cannot be minimized further. The result is the best representation of the decision areas in two dimensions.

In more mathematical terms, Stress is like a standard error of the estimate in bivariate regression analysis. One could construct a graph in which one axis would be labeled Input Proximity Values and another Empirical Distance Values, those calculated for a particular configuration. A monotonic curve could be fitted through these points and the sum of squared deviations of the points about this curve calculated. Because this squared deviation sum is normalized in the program, Stress can be expressed as a proportion or percentage. An example of such a graph (hypothetical) is shown in the figure below. This type of process is done mathematically for each instance in which a new configuration is generated--the graph is used here for heuristic purposes.



In fact, we did not know how many dimentions would best represent our data. A problem existed in this respect in that if the number of decision areas were not large relative to the number of dimensions, we risked obtaining a low-stress final configuration which was an inaccurate representation of the true relationship among the decision areas. This means that we had to be careful that the number of decision areas relative to the number of dimensions was large enough to produce a unique configuration. To handle this problem Subkoviak (1975)provides a formula for computing the recommended minimum number of objects (decision areas) to be clustered for any particular number of dimensions. The formula is:

$$n = 4r + 1$$

where r = the number of dimensions and n = the number of objects.

On the basis of this we decided to specify three as the maximum number of dimensions in which the program would try to represent our data. By doing this the program generates a best solution in 3 and, if possible, 2 and 1 dimensions. Naturally, we opted to select the solution in the fewest dimensions.

It should be mentioned that Stress and the number of dimensions are related. Stress will decrease each time a new dimension is added since that allows more freedom for arranging points, which in turn allows closer agreement between the rank order of the input proximity values and the order of those calculated for the configurations. Notabley, a zero Stress can always be obtained for n objects in n-1 and even fewer dimensions. However, zero stress is not the ultimate criterion. What one desires is a simple interpretable representation of the basic dimensions needed to account for

the relationships among the objects, the decision areas in our case, at the expense of a little Stress.

One can compare empirically-obtained Stress values with those calculated for random data using the same number of objects. If they are significantly lower than those for random data, one can safely conclude the data are not random and are amenable to multidimensional meaningful represenation. If not, then the real data proximity values are essentially error or else that the relationship among the objects cannot be represented as distances between points in geometric space.

We did not attempt to compare our Stress values with any such randomly generated ones. Subkoviak indicates that most systematically generated data will produce Stress values lower than those for random data. This means that rejecting the randomness hypothesis would not insure one had a nonrandom set of proximity values. There also exists an apparent lack of coherent techniques for comparing Stress values of n objects in r dimensions.